industrial discoveries along these lines have been very far-reaching. The success attending the investigation of various chemical reactions occurring at high temperatures has caused a marked revival in the interest taken in inorganic chemical research. This has been especially noticeable on the Continent, where, to a much greater extent than with us, the brilliant and rapid development of organic chemistry had led to a marked neglect of this older branch of the science.

The technical results are hardly less important. Several new and flourishing industries have been firmly established, some of them supplying hitherto unknown materials, which are proving themselves of great value in the arts. A still wider field of usefulness for the electric methods of heating seems now to be opening up. So far as the electrolytic and high temperature applications are concerned, there has been no direct competition with any existing technical processes. But now that the engineer and chemist have become familiar with the use of the electric furnace, there is a great tendency to extend its employment to work which requires temperatures already attainable by fuel heating if properly applied.

The possibility of generating the heat just where it is required, the ease of regulation of temperature, and the accompanying economy of heat losses, are the chief factors which tell in favour of electric heating under these conditions. The production of carbon bisulphide and the rapid development of the electrical manufacture of steel form excellent examples of what is being achieved technically in this direction; whilst even in the laboratory electrically heated tube and muffle furnaces are being largely employed in place of those heated by gas.

It is with the interesting details of such subjects as these that M. Minet is concerned. In view of the fact that this is but the first part of his complete work, it is impossible to do more than point out these main divisions of the subject. The author has drawn largely on the patent literature, and has copiously illustrated his descriptions with excellent diagrams and with the portraits of many of the leading investigators in this field of work. R. S. HUTTON.

OUR BOOK SHELF.

Elementary Microscopy. By F. Shillington Scales, F.R.M.S. Pp. xii + 179. (London: Baillière, Tindall and Cox, 1905.) Price 3*s.* net.

No instrument of research has such wide application in various branches of science and commerce as the microscope. It is, perhaps, scarcely too much to say that the principles underlying its construction and use are often disregarded by those who employ it, and sometimes totally ignored. Any treatise, therefore, on this subject, however unpretentious, is to be cordially welcomed, and the book now under notice is one that should meet a pressing need. It is written for beginners or for those who have used a microscope without troubling to understand it, and who consequently have never by any chance used it at its best.

The book commences with a description of various simple magnifiers and a descriptive diagram showing the essential parts of a microscope. These parts and the various accessories are in turn described more fully, as well as such appliances as are usually only found in the best instruments.

The most important points, such as substage condensers and fine adjustment construction, are treated somewhat fully. As to the choice of a microscope, reference is made to the fact that in medical schools and elementary science laboratories, where the cheaper form of instrument is usually provided, still no instruction is given as to its use, and that it is too often looked on as a mere magnifying glass. This is unquestionably true, and it is much to be deprecated that, in cases where the microscope performs such an important part in the work of instruction, no attention whatever is bestowed on its principles and use. The most interesting paragraphs in the book are, perhaps, those in which a comparison is made between the English and Continental stand. That the form of instrument now known as the English model is generally much superior in design and construction to the Continental stands is admitted and insisted on by the majority of those whose opinion is of value. At no period for many years past has the English microscope stand held such a high place, and it is greatly to be hoped that those who are in a position which gives them opportunities of recommending one form or another will recognise this. It is much to be regretted that, so far as objectives are concerned, the same cannot be said. Some English makers do undoubtedly produce lenses of good quality, but the average is not so high, and the finest objectives produced by Messrs. Zeiss are still unexcelled by those of any other makers. In the production of substage optical appliances, this country holds, as it has always done, a very high position, and it is difficult to understand why the same cannot be said of objectives. All the usual microscope accessories, as well as their method of use, are described as fully as the circumstances permit.

Chapters vi. and vii. are devoted to the practical optics of the microscope and its manipulation. This is the most important section of the book, and should be carefully studied. Perhaps more space might have been devoted to this, although it is quite easy to understand the difficulties that might arise in attempting anything like an exhaustive treatise on microscopic optics, debatable as the subject still is.

Altogether, the book is to be commended as a genuine attempt to treat the subject in a simple straightforward manner, so that the reader for whom it is primarily intended may grasp its meaning without difficulty. J. E. B.

The Practical Photographer's Annual, 1905. Edited by Rev. F. C. Lambert. Pp. xxxvi + 160. (London: Hodder and Stoughton, 1905.) Price 1*s.* 6*d.* net.

THESE pages, as we are told in the preface, are intended to serve no other purpose than to aid the memory of the busy photographer, and if possible to anticipate his daily needs.

An examination of the book shows that the editor has very successfully accomplished his task, and at the same time has not made the volume of such a bulky nature as to render its size inconvenient. It is true that more references might have been inserted, but such an addition would perhaps be questionable.

The four sections into which the book is divided include a dictionary of practical hints, dodges, &c.; a collection of tables, weights, measures, everyday formulæ, &c.; a directory of the photographic societies of Great Britain and Ireland; and finally, a set of indices to the first twelve numbers of the present (library) series of the *Practical Photographer.* Each

of these sections is arranged so far as possible alphabetically, so that ready reference is greatly facilitated. We thus have a concise and practical dictionary which should be found of very general utility.

Murray's Handbook of Travel-Talk. Nineteenth edition. Pp. 688. (London: Edward Stanford, 1905.) Price 3*s.* 6*d.*

THAT this little pocket-book meets the requirements of travellers is shown by the fact that this is the nineteenth edition that has been issued. The success of such a companion depends mainly on the arrangement and scope of the material which it contains, and on these points it seems difficult to suggest any improvements. This edition is divided into fourteen distinct but comprehensive groups of subjects, each one containing exclusively those words and phrases which naturally belong to each section. Great pains seem to have been taken to bring the information up to date, motoring, for example, having quite a large part devoted to it. The Britisher is equally helped in either French, German, or Italian, and such a *vade mecum* as is here presented should be found of great service to everyone who crosses the Channel.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Pressure of Radiation on a Clear Glass Vane.

IN NATURE, June 29, a letter from Mr. G. F. Hull appeared under the above title. In it the writer claims to have verified experimentally that the pressure upon a transparent vane is equal to the difference in the density of energy in front of and behind the vane, and reference is made to a difference of views regarding the theory of the pressure in a non-absorbing medium.

In regard to the latter point, the same result is obtained for the particular case in question whether the beam of light is considered simply as a carrier of momentum or whether the pressure due to radiation is regarded as arising from a mechanical bodily force integrated throughout the material medium in which the radiation is being propagated. Consider the latter theory for steady radiation consisting of plane polarised waves of simple harmonic period $2\pi/\kappa c$ propagated along Ox (see Larmor, *Phil. Mag.*, vol. vii., p. 578, 1904).

We have

$$\frac{\epsilon}{c}\frac{\partial Y}{\partial t}=-\frac{\partial \gamma}{\partial x};\quad -\frac{1}{c}\frac{\partial \gamma}{\partial t}=\frac{\partial Y}{\partial x};$$

where ϵ is complex if the medium is absorbing.

The mechanical force per unit volume is directed along Ox and is given by

$$F=\frac{I}{c}\gamma\ .\ (\text{true current})=-\frac{\partial}{\partial x}\left[\frac{\gamma^2}{8\pi}+\frac{1}{8\pi\kappa^2c^2}\left(\frac{\partial Y}{\partial t}\right)^2\right].$$

If all the interfaces are perpendicular to Ox, then γ and Y are continuous throughout, whether the medium vary continuously or abruptly; consequently the mean value of the mechanical force upon any slice of the medium can be expressed as a pressure per unit area upon each surface equal in amount to the mean value of $(\gamma^2+Y^2)/8\pi$ at the surface. Thus for any vane suspended in free æther (or air) the resultant mechanical force is equivalent to a pressure per unit area equal to the difference in energy-density in front of and behind the vane.

The apparent confusion arises from the usual statement that the mean value of γ^2+Y^2 can only vary along Ox in the case of an absorbing medium, but this is true only for progressive waves. For a transparent medium of refractive index n conveying progressive and regressive waves the mean value of $(\gamma^2+n^2Y^2)/8\pi$, or the mean value of the energy density, is constant; but the mean value of $(\gamma^2+Y^2)/8\pi$ varies harmonically along the direction of propagation. For a plate extending from $x=0$ to $x=h$, and subjected to a normally incident beam of mean energy-density I, it can easily be verified that the mean value of $(\gamma^2+Y^2)/8\pi$ within the plate is equal to

$$I\{(n^2+1)^2-(n^2-1)^2\cos 2n\kappa(h-x)\}/\{(n^2+1)^2\sin^2 n\kappa h+4n^2\cos^2 n\kappa h\};$$

consequently the resultant pressure is equal to

$$2I(n^2-1)^2\sin^2 n\kappa h/\{(n^2+1)^2\sin^2 n\kappa h+4n^2\cos^2 n\kappa h\},$$

or equal to $2J_0I$, where J_0 is the normal reflecting power of the plate for the radiation used.

T. H. HAVELOCK.

St. John's College, Cambridge, July 14.

An Omitted Safeguard.

IN two schemes set out in a recent issue of NATURE, one dealing with the requirements of Oxford and one with the organisation of applied science in London, there appears a noteworthy omission.

If the weather is proverbially the first topic of conversation of Englishmen, it is surely because of the influence it has on the well-being of the community.

Yet in both the schedules referred to no provision is made for research in meteorology. It is singular how tardy is the recognition of so important a factor in the national welfare. It is to meteorology that we constantly appeal for help. By its daily survey of rainfall it safeguards our water supply (now a very anxious problem, being outpaced by the ever-increasing demands of population, sanitation, railways, or manufacturing machinery). We turn to it for the comparison of localities and to study the effects of climate or fog upon health and disease, or to ascertain the relations of temperature, sunshine, or rainfall to the prosperity of the crops and fruit gardens. We look to the readings of the barometer to protect the safety of those working underground. Meteorology takes cognisance of the force of the wind for the protection of structures, or of storms likely to imperil the mariner on his voyage, and by the extension of, and the improved modes of, forecasting the weather is becoming each year of greater service to all.

Without encroaching further upon the limits of your space, sufficient has perhaps been said to show *primâ facie* grounds (while so much is proposed to be devoted to physics, geology, or botany) for the consideration of a possible chair in meteorology, or for in some other way repairing an omission of so serious a kind in the schemes lately propounded. The large amount devoted annually to meteorology in the United States shows the appreciation of its utility to all classes of the community by so practical a people as the Americans, and that the outlay is amply recouped by the value of the services rendered by it.

RICHARD BENTLEY.

The Hydrometer as a Seismometer.

IN NATURE of June 29 Mr. Bennett discusses the motion of a floating hydrometer when vertical motion is imparted to the (rigid) vessel containing the (incompressible) fluid in which the hydrometer floats. The solution offered is that the whole system moves precisely as a rigid body would move, and this solution clearly satisfies the very simple equations of motion in the problem considered. But is such motion stable? In general it is not, and I believe that Faraday studied experimentally the "crispations" of a free surface of liquid when small vertical oscillations were imparted to the containing vessel.

This hardly affects Mr. Bennett's conclusion that a floating hydrometer is an unsatisfactory form of seismometer, but perhaps it may explain the positive results which some observers have obtained; elastic yielding of vessel or hydrometer, although conceivably an adequate explanation, is not the only one open to us.

Cambridge. C. V. BURTON.